# Trends, Risks, and Climate for a 2016 NEPA Categorical Exclusion Application: Malheur, Umatilla, and Wallowa-Whitman National Forests

***NE Oregon Ecology Program***

Serving:

- Malheur,
- Umatilla, &
- Wallowa-Whitman National Forests

***Blue Mountains Forest Insect and Disease Service Center***

Serving:

- Malheur, Umatilla, & Wallowa-Whitman National Forests
- Burns & Vale Districts, Bureau of Land Management
- Confederated Tribes of the Umatilla Indian Reservation

Michael Jennings, Ph.D., Ecologist
michaeldjennings@fs.fed.us

February 22, 2016

## INTRODUCTION

This report was developed to provide the Malheur, Umatilla, and Wallowa-Whitman National Forests with information needed in applying for a NEPA Categorical Exclusion(CE) under the Agricultural Act of 2014 (Public Law No: 113-79) also known as the 2014 Farm Bill. Reported here are:

1. Trends in beetle caused mortality of trees in recent years;
2. Risk of beetle caused tree deaths in the near future; and
3. Climate forecasts.

The trees of these forests are currently undergoing a rapid expansion of mortality from bark beetles. Significant portions of the forests are at risk of additional tree deaths in the near future. Population levels of bark beetles respond largely to a combination of forest stand conditions and climate (Bentz et al. 2010). The Categorical Exclusion being sought will provide natural resource managers with the flexibility needed to respond to what is now a rapidly growing threat to the health of these forests combined with future climate conditions that, while somewhat uncertain, present the clear danger of high levels of tree mortality over the next several years.

The information contained in this report applies only to the areas of these forests that are being proposed for Categorical Exclusion status. Under this CE designation, specific forest management practices are not being proposed for these areas, rather, it would be within these broad areas that various treatments, such as thinning or fuel reduction may be carried out on smaller parcels as needed.

## PROPOSED AREA

This proposal applies to portions of the Malheur, Umatilla, and Wallowa-Whitman National Forests in the Blue Mountains of northeastern Oregon and portions of central Idaho. The location and specific areas proposed for CE status are shown in Figures 1 and 2, below.

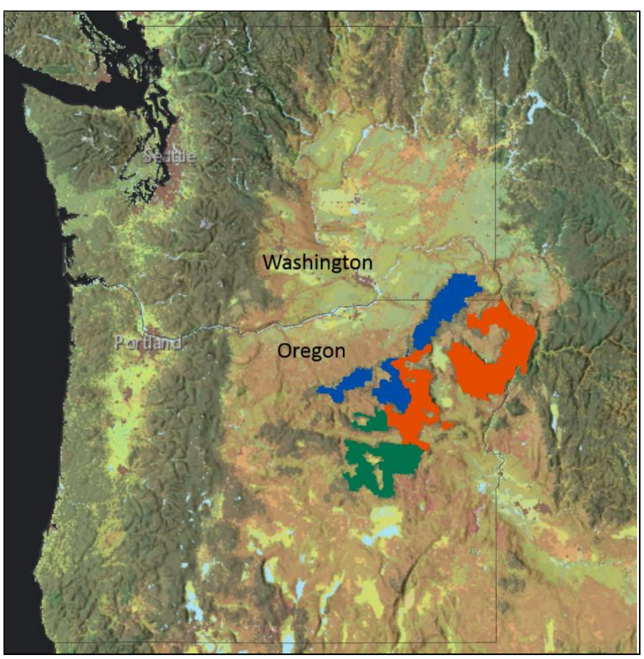


Figure 1. Locations of the National Forests.
Malheur, Umatilla, Wallowa-Whitman

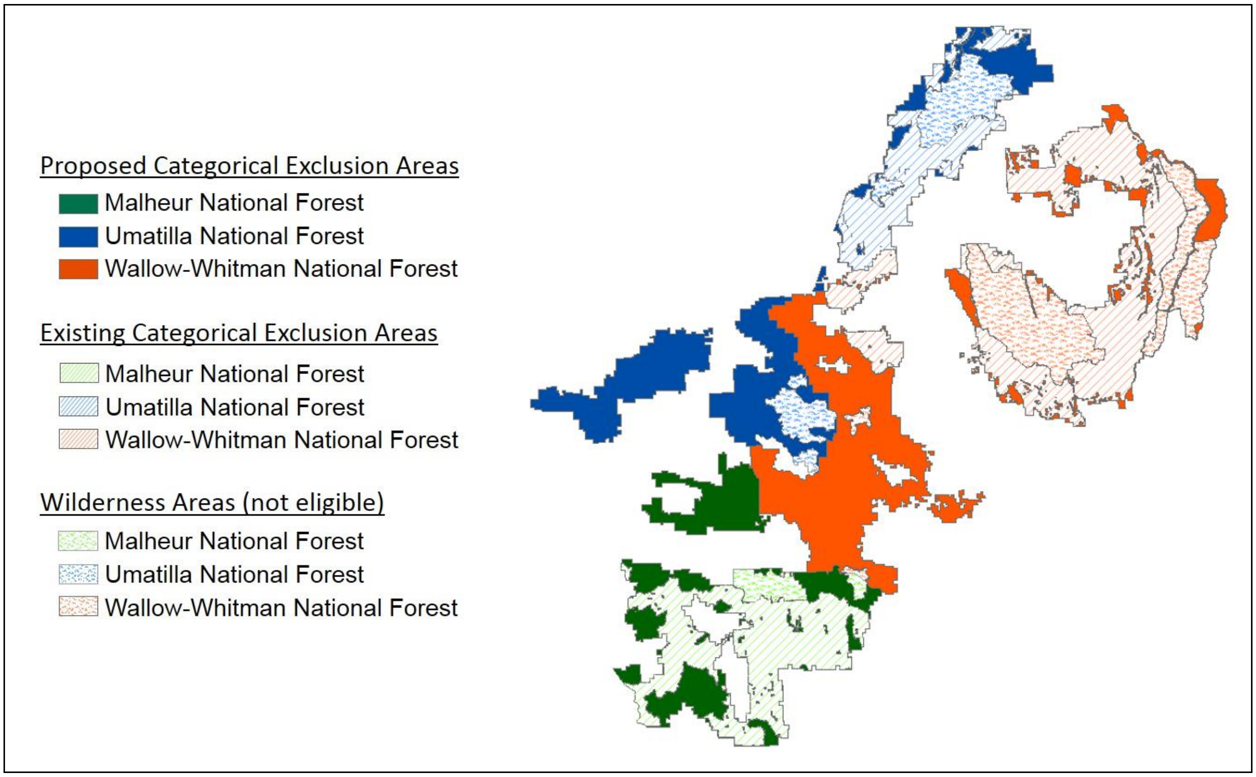


Figure 2. Proposed area of Categorical Exclusion by National Forest.

The 6th Level Hydrologic Unity Codes (HUCs) of the proposed area are shown in Table 1. A shapefile of these HUCs can be downloaded here.

Table 1. 6-Digit Hydrologic Units of the Proposed 2016 Blue Mountains Categorical Exemption Area

| Name | Code |
|---|---|
| Middle Columbia | 170701 |
| Middle Snake-Boise | 170501 |
| Deschutes | 170703 |
| Middle Snake-Powder | 170502 |
| John Day | 170702 |
| Oregon Closed Basins | 171200 |
| Lower Snake | 170601 |

The size and relative amounts of these areas is shown in Table 2.

Table 2. Size of proposed CE areas.

| Proposed CE Area | Acres | Percent |
|---|---|---|
| Malheur NF | 522,863 | 40 |
| Umatilla NF | 778,611 | 52 |
| Wallowa-Whitman NF | 1,063,183 | 39 |
| Total | 2,364,657 | 100 |

TRENDS IN BARK BEETLE INDUCED TREE MORTALITIES

The most important bark beetle species causing tree mortality in these forests are: (1) mountain pine beetle (*Dendroctonus ponderosae*), (2) western pine beetle (*Dendroctonus brevicomis*), (3) Douglas-fir beetle (*Dendroctonus pseudotsugae*), and (4) fir engraver (*Scolytus ventralis*).

In the three years since 2012 average annual tree mortality caused by these bark beetles increased more than 13-fold over the average annual mortality of the previous five years and 11-fold over the previous ten years (Figure 3). At the same time the total area of infestation doubled (Figure 3). These trends indicate a substantial and ongoing intensification of bark beetle populations.

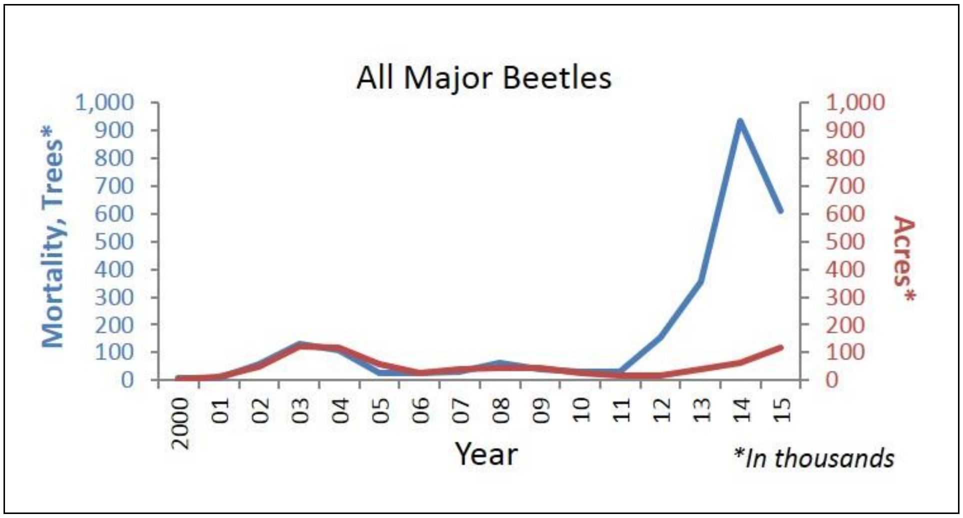


Figure 3. Tree mortality and acres infested, 2000 to 2015, in the area proposed for CE status (data from: Annual Forest Insect and Disease Aerial Detection Survey).

RISK OF BEETLE CAUSED TREE DEATHS IN THE NEAR FUTURE

About 20 million square feet of basal area (13%) in the proposed CE area is at risk of a minimum 25% mortality to bark beetles over the next 11 years (Table 3). The proposed CE area covers more than 2.2 million acres which support about 155 million square feet of tree basal area.

This risk is based on forest stand conditions. It assumes climate conditions that were normal from 1950 to 2000. It does not reflect risk due to a changing climate, which is now a considerable insipient risk factor. Bark beetle population dynamics respond to climate variables and climate related stress of trees predisposes them to mortality caused by bark beetles as well (Bentz 2010). Expected changes in climate conditions are described in the next section.

Table 3. The amount of risk for basal area loss.[1]

| Proposed CE Area | Treed Area, Acres | Total Basal Area[2] | Basal Area per Acre[2] | Amount of Basal Area at Risk[2, 3] | Percent of Basal Area at Risk[3] |
|---|---|---|---|---|---|
| Malheur | 523,172 | 34,597,611 | 75 | 5,541,470 | 16% |
| Umatilla | 728,174 | 43,953,403 | 66 | 4,433,405 | 10% |
| Wallowa-Whitman | 979,576 | 76,640,910 | 86 | 9,947,566 | 13% |
| Entire 2016 CE Area | 2,230,921 | 155,191,923 | 76 | 19,922,441 | 13% |

1. Data from Krist and others (2014).
2. Square feet.
3. At a minimum, 25% live basal area will die within the next 11 years.

CLIMATE FORECASTS

While biotic responses to climate are complex and not perfectly understood, approximating expected climate conditions of the future to better describe the potential for bark beetle induced tree mortalities can provide a vitally important forward looking perspective. A common way to express seasonal climate properties relevant to the vegetation of a place and time is with Walter Climate Diagrams (Walter 1995). The Walter climate diagrams shown in Figure 4 were developed from downscaled spatial climate data that express past (Hijmans et al. 2010) as well as forecasted (Donner et al. 2011) climate conditions of the proposed CE area.

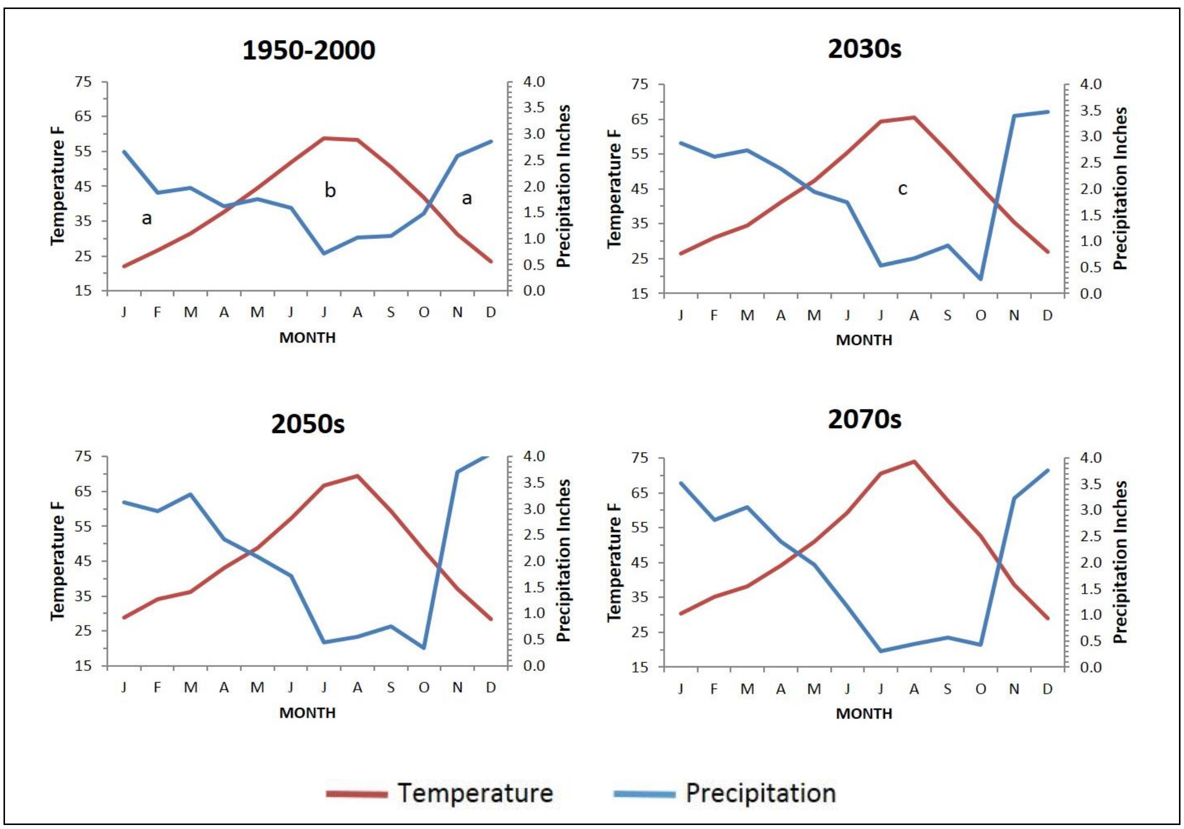


Figure 4. Walter climate diagrams of the proposed CE area. a: period of water surplus; b: period of water deficit; c: area between the curves.

In Figure 4, the area between the temperature and precipitation curves (c) represents both the growing season and, typical to the Northwest, the seasonally dry summer. Periods, where precipitation exceeds temperature (a), are periods of water surplus and runoff. Periods where temperature exceeds precipitation (b) are periods of water deficit. Changes in climate characteristics important to vegetation can be seen in both the shape and the size of the area between the curves. The shape of the area between the curves describes how climate drives phenology. The size of the area between the curves describes the magnitude of temperature-precipitation relationship during the growing season. Changes in the shape and size of the area between the curves can exert a profound influence on vegetation. Changes in the size of the areas between the curves in these diagrams are shown in Table 4.

Table 4. Changes in the size of the areas between the curves.

| Period | Percent Change |
|---|---|
| 1950-2000 to 2030s | 31% |
| 2030s to 2050s | 12% |
| 2050s to 2070s | 18% |
| Cumulative | 50% |

The data behind these diagrams indicate that the length and magnitude of the area's seasonal water deficit is expected to increase substantially over the next several decades. This is evident by changes in the shape and size of the area between the curves from the 1950-2000 period through the 2070s decade. Even by the 2030s, 15 years from now, the summer drought period is expected to become hotter, drier, and longer. At the same time precipitation during the period of water surplus is expected to increase moderately. However, evaporation and evapotranspiration will increase with higher temperatures, resulting in less available ambient water. Because of higher temperatures it is expected that snow pack will be less and rain events heavier, resulting in greater runoff of the total precipitation. This implies significant changes in soil moisture as well as stream hydrology.

The changing direction of climate conditions—warmer-wetter winters and drier-hotter summers—is conducive to increased bark beetle and other forest insect populations, and thus more widespread tree mortality. Future conditions may also favor more extensive forest root diseases, which induce tree stress, making trees more susceptible to bark beetles attack and tree mortality.

## SUMMARY

Tree mortalities from bark beetles over the last four years are about 11 times higher than the average annual level of the previous 10 years. About 20 million square feet of basal area is at risk of loss to bark beetles over the next 11 years, however this estimate does not include effects that are expected due to climate change. The bark beetle impacts to forest resources expected from climate change have not been quantified for the proposed CE area, but are expected to be substantial.

LITERATURE AND DATA CITED

Annual Forest Insect and Disease Aerial Detection Survey; 1947-2015; Forest Health Protection, State and Private Forestry, Pacific Northwest Region, Forest Service, U.S. Department of Agriculture; Washington Department of Natural Resources, Resource Protection Division, Forest Health; Oregon Department of Forestry, Forest Health Management.

Bentz, B. J., J. Régnière, C. J. Fettig, E. M. Hansen, J. L. Hayes, J. A. Hicke, R. G. Kelsey, J. F. Negrón, and S. J. Seybold. 2010. Climate Change and Bark Beetles of the Western United States and Canada: Direct and Indirect Effects. BioScience **60**:602-613.

Donner, LJ, B Wyman, RS Hemler, et al. 2011: The dynamical core, physical parameterizations, and basic simulation characteristics of the atmospheric component AM3 of the GFDL Global Coupled Model CM3. Journal of Climate 24(13), DOI:10.1175/2011JCLI3955.1.

Hijmans, RJ, S Cameron, and J Parra. WorldClim - Global Climate Data, Data for current conditions (~1950-2000), 30 arc-seconds (~1 km), Bioclm. Available online: [http://biogeo.ucdavis.edu/data/climate/worldclim/1_4/grid/cur/bio_30s_esri.zip]. Accessed 28/06/2010.

Krist, F.J. , J.R. Ellenwood, M.E. Woods, A.J. McMahan, J.P. Cowardin, D.E. Ryerson, F.J. Sapio, M.O. Zweifler, and S.A. Romero. 2014. 2013–2027 National Insect and Disease Forest Risk Assessment. United States Forest Service, Forest Health Protection, Ft. Collins, Colo., USA. FHTET-14-01, 199p.

Walter, H. 1985. Vegetation of the earth and ecological systems of the geo-biosphere. Springer-Verlag, translation, 3rd edition.